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MOUTHPARTS SENSILLA OF THE WORKER ANT *LEPTOGENYS DENTILOBIS* (HYMENOPTERA: FORMICIDAE)

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Abstract: The mouthparts of the worker cast in the ant, *Leptogenys dentilobis* are directed forward and adopted for biting and cutting type. The mouth parts consist of broad lobulated labrum, mandible with sclerotized incisors and molar cups, palped laterally placed maxillae, and the labium which forms the lower lip. Scanning electron microscopic (SEM) studies of the mouthparts revealed the presence of two major types of sensilla. i.e. sensilla trichoidea and sensilla trichoidea curvata. These sensillae though present in all the mouth parts, exhibit variation in their morphology, density and number and are site specific.

Keywords: mouth parts, SEM, sensilla, *Leptogenys dentilobis*.

Introduction

The genus, *Leptogenys dentilobis,* has attracted attention due to its wide variety of social organization and colony structure as well as its remarkably diverse range of behaviors. In ants the mouth parts consists of pair of mandibles, maxilla and labium. The labium is formed due to fusion of paired structure the second pair of maxillae (RICHARDS & DAVIS, 1987). All ants are mandibulated and the range of mandibular activities are extended to nest construction and defense of the colony, cut and transport of food debris and transport of larvae and eggs (WHEELER & WHEELER, 1970). They are strongly chitinized structure commonly known as jaw and always articulate in transverse plane. Ants consist a triangular mandibular elongated masticatory margin with noticeable sharp pointed curved apical and pre-apical teeth and a prominent basal angle (CAPINERA, 2008). In the adult ants the mouth parts are equipped with mechano and chemoreceptors (GOTWALD, 1969; WHEELER & WHEELER, 1970; PAUL *et al.*, 2002). Mandible is modified as defensive organ and also in-charge the protection of their nest. In ants the worker caste play major role in colony nest construction and the mandibles are directly related to the ants diet (CAPINERA, 2008).

The SEM studies revealed the presence of several mechano as well as chemoreceptors on the surface of mouthparts of ant. The sensilla present on the mouthparts

help in detection of pray in many ants (KAISSLING 1976; BARSAGADE *et al.*, 2013; GATHALKAR & BARSAGADE, 2016). No major attempts have been undertaken to study the mouth part sensilla of *L. dentilobis*. The present paper describes the ultrastructure of the mouthparts with special reference to the sensillae present over there.

Materials and Methods

Material:

The colony of ant *Leptogenys dentilobis* was observed in MJF Educational Campus RTM Nagpur University, Nagpur (Fig. 1 a). The worker ants were collected, anesthetized with chloroform and preserved in 70 % alcohol, the ant were identified with the help of database available on Iternet and the same was confirmed from experts.

Methods:

Morphological preparation (In situ): The collected worker ants used for Scanning Electron Microscopic analysis were immobilized on ice and mouthparts were carefully removed and fixed in 70% alcohol for 12 hrs. The material was dehydrated in ethanol and cleared in acetone. The air dried mouthparts were fixed on metallic stubs at different angles with the help of superglue and were gold-coated separately. The material was scanned at a desirable magnification under a JOEL Scanning Electron Microscope (JSM 6380A) at the SEM centre of Visvesvaraya National Institute of Technology, Nagpur, India.

Statistical Analysis:

Sensillae on mouthpart were measured, identified and counted amongst worker individuals. Measurements were taken from individuals and the means were calculated with standard deviations. However, data on total and differential numbers in different sensillae were counted and calculated through the scanning electron micrographs and the mean were separated by the least significant difference (LSD) test. Consequently, significant values were obtained using Graph-pad Quick Calcs.

Results and Discussion

The mouthparts of worker *L. dentilobis* are adapted for biting and cutting the food. The mouthparts consisted of the labrum, mandible, maxilla, and labium (Fig.1).

Labrum:

The labrum is a bilobed, flattened structure and each lobe is triangular in shape (Table.1). Numerous small setae are found along the distal margin while the lateral borders are covered the long setae. Intermediate size setae are found in the middle area of the extensor surface (Fig.1 c-e). Two types of sensilla are found on the labrum, the sensilla trichoidea (ST) and the sensilla trichoidea curvata (STC). Trichoid sensilla are simple articulated sensory hairs of the

body surface while the sensilla trichoidea curvata (STC) are long and curved at the tip (Table. 2). Morphology categorizes the trichoid sensilla as ST-I, ST-II, ST-III on the basis of their length in the group.

Mandible:

The mandibles are unsegmented and strongly sclerotized, long with a scope like cuticular structure and are the largest element of the mouthparts. Each mandible bears along the longitudinal edge or outskirt of the cutting edge a row of highly sclerotized incisor teeth (10), which open outwards (to the sides of the head) and come together medially. (Fig. 1 b, d and f, g). The dorsoventral surface of the mandibles bears trichoid sensilla (ST) and sensilla trichoidea curvata (STC). The trichoid sensilla are differentiated into ST-I, ST-II, and ST- III type. The sensilla trichoidea are present on the marginal area of the ventral region. (Table 2).

Maxilla:

The maxilla is situated beneath the mandibles. Each maxilla consists of cardo, stipes, galea and the maxillary palp. The maxillary palps are three segmented. Stipes are sub-rectangular, galea typically formicoid with a well developed maxillary comb. At the outer margin, the galea is cupped or scooped (Fig. 2 a-d). The surface of the maxilla are covered with sensilla trichoidea which are further subdivided into sensilla trichoid I, sensilla trichoidea II and sensilla trichoidea III. The inner surface of the maxillae is also filled with sensilla trichoidea (Table 2).

Labium:

The labium or the lower lip is formed by the fusion of two secondary maxillae. The labrum is divisible into three sections- the central mentum, followed by the sub-mentum and the distal prementum. The prementum bears two sets of flaps the glossae and the paraglossae and a pair of three sectioned labial palps (Fig. 2 b-d). The surface ultrastructure of labium reveals sensilla trichoidea and sensilla trichoidea curvata while the labial palp bears three types of sensilla trichoidea, ST-I, ST-II, ST-III (Table. 2).

Discussion

In most of the ant species, the mouthparts are adapted for grasping and feeding (SNODGRASS, 1935; DUMPERT, 1972; RICHARD & DAVIS, 1987; CHAPMAN, 1982, 1988). The mouth parts of *L. dentolobis* are adopted for biting and cutting type with various types of sensilla. The morphology, distribution and size of the mouthpart sensillae has been studied in various insects (*Manduca sexta*, *Choristoneura fumiferana, Spodoptera exigua* and *C. Corneana*) by the earlier workers (ALBERT, 1980; CHEN & HUA, 2014). Sensilla trichoidea are freely movable setae and form

hairs of variable length with generally a proportional diameter with respect to length. They perform multiple functions such as mechano-sensory, chemo-sensory and thermo-sensory; sensitive to touch, vibrations, air movements and sound sense receptors (ERICKSON *et al.*, 2009). The trichoid sensillae on the mouthparts generally serve as mechanoreceptors (PAUL *et al.,* 2002; ALBERT, 1980; CHEN & HUA, 2014). In *L. dentolobis* it is observed that the mouthparts are adapted for biting and cutting with two types of sensilla- sensilla trichoidea and sensilla trichoidea curvata. However, in several respects they are also similar to the mouthparts of many ponerines (CHEN & HUA, 2014). Similar sensilla present on mouthparts of *M. brunn*ea are equipped with mechano and chemoreceptors (PAUL, 2001; PAUL *et al.,* 2002,), in *L. dentilobis* the sensilla may function as mechano and chemoreceptors as found in other Myrmicinae ants. The mandible in *M. brunnea* are powerful tools for catching prey, fighting, digging, seed crushing, wood-scraping, grooming, brood care and trophallaxis (PAUL, 2001, HOLLDOBLER & WILSON, 1990) and in *L. dentilobis* too, the mandlbles serve similar function. In *L. dentilobis* the dorsal and ventral side of the worker mandibles possess densely distrubeted tufts of trichoid sensillaof different length, similar situation is found in other ants too (ZACHARUK, 1980; BARSAGADE *et al.,* 2010).

Although BABU *et al.,* 2011 reported the presence of olfactory sensilla (gustatory sensilla) in the mouthparts of the weaver ant *Oecophylla smaragdina* such sensillae are absent from the mouthparts of *L. dentilobis.* The patterning of sensillae on the mouthparts of *L. dentilobis* are species specific and are used for food detection.

Table 1. Morphology of mouthparts of ant *Leptogenys dentilobis.*		
MOUTHPARTS	**LENGTH (µm)**	**WIDTH (µm)**
Labrum	204.2±0.55	444.2±0.67
Mandible	952.3±0.69	249.6±0.44
Maxilla	491±0.70	222±0.41
Maxillary palp	250±0.65	62.48±0.70
Labium	866±0.54	371.3±0.45
Labial palp	191.3±0.69	58.32±0.48

Table 2. The size of the sensilla on the mouthparts of worker *Leptogenys dentilobis*				
Sr. No.	**MOUTH PARTS**	**TYPES OF SENSILLA**	**LENGTH (µm)**	**WIDTH (µm)**
1	Labrum	ST-I	80.94±0.68	7.52±0.07
		ST-II	59.52±0.71	3.95±0.45
		ST-III	35.71±0.71	0.15±0.01
		STC	38.08±0.70	0.04
2	Mandible	ST-I	316 ±0.70	16.62±0.71
		ST-II	216± 0.25	9.69±0.69
		ST-III	91.63±1.02	9.69± 0.47
		STC	125±0.69	0.03
3	Maxilla	ST-I	241.3±0.69	9.69± 0.57
		ST-II	75±0.68	9.69±0.64
		ST-III	50±0.65	9.69±0.70
4	Maxillary palp	ST-I	45.82±0.68	9.69±0.59
		ST-II	37.4±0.67	9.69±0.67
		ST-III	29.15±0.55	9.69±0.48
5	Labium	ST-I	162.4±0.67	6.92±0.53
		ST-II	70.82±0.54	4.84±0.46
		ST-III	45.82±0.59	4.84±0.63
		STC	62.4±0.67	0.03
6	Labial palp	ST-I	29.15±0.71	4.84±0.59
		ST-II	25±0.64	4.84±0.62
		ST-III	16.31±0.45	4.84±0.71

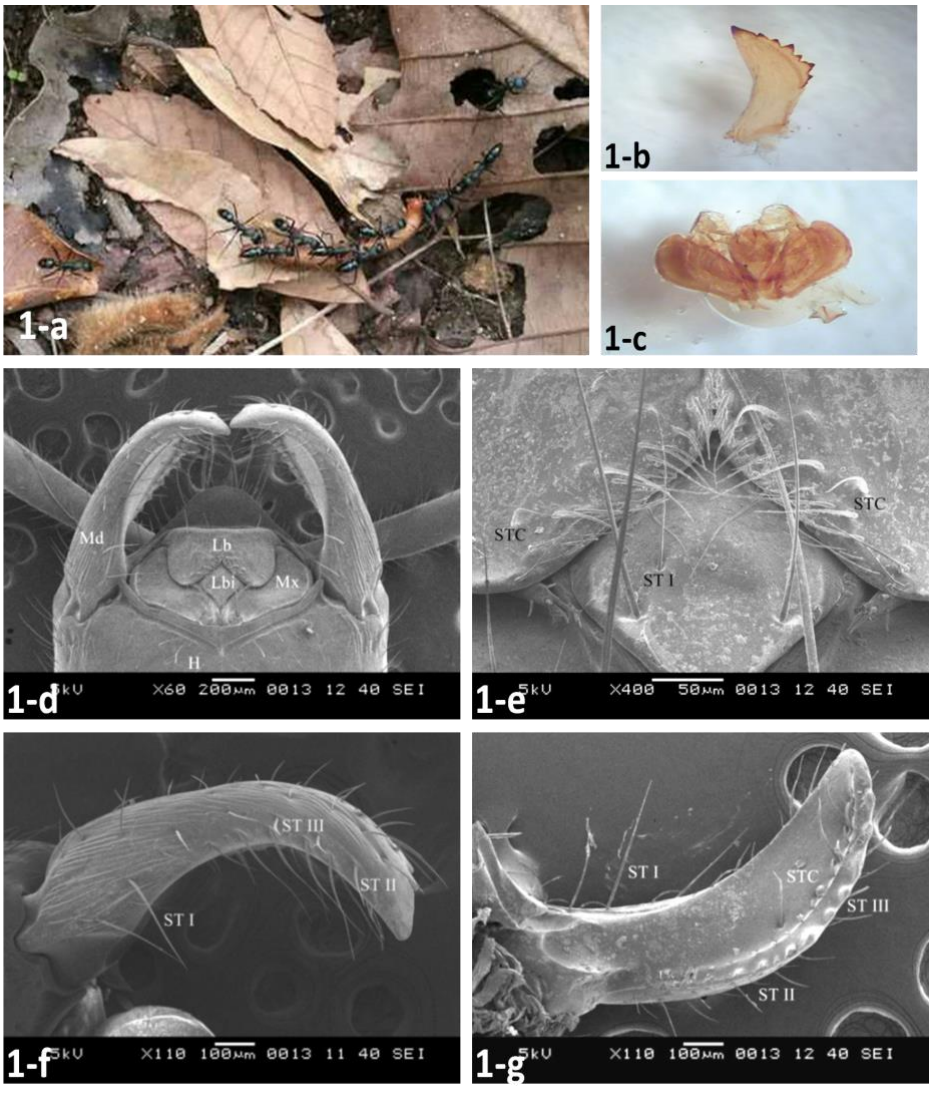

Fig. 1: Light microscopic photograph and Scanning Electron Microscopic Photograph of *Leptogynus dentilobis* showing- **1-a:** Workers colony, **1-b:** Dorsal view of mandible, **1-c:** Dorsal view of labio-maxillary complex, **1-d:** Ventral view of mouth parts, **1-e:** Magnified view of labrum with sensilla, **1-f & g:** Ventral and Dorsal view of Mandible with sensilla. **(H-** Head, **Md-** Mandible, **Mx-** Maxilla, **Lb-** Labrum, **Lbi-** Labium, **ST**- Sensilla Trichoidea, **Stc-** Sensilla Trichoidea Curvata).

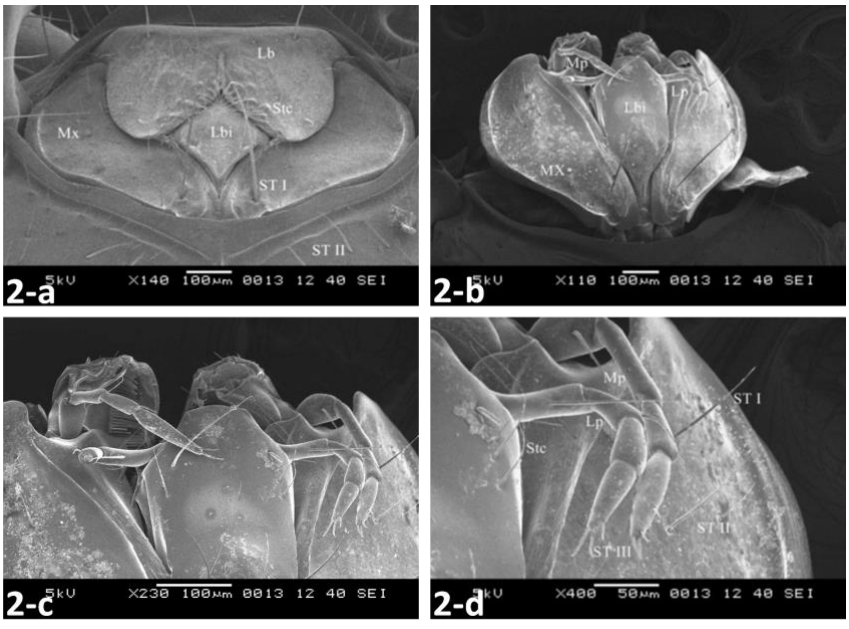

Fig. 2: Scanning Electron Microscopic Photograph of *Leptogynus dentilobis* showing **2-a:** Complete view of labio-maxillary complex, **2-b:** Open view of labio- maxillary complex, **2-d:** Magnified view of labio-maxillary complex **2-d:** Labial and maxillary palp**. (Mx-** Maxilla, **Lb-** Labrum, **Lbi-** Labium, **Lp-**Labial palp, **MP-** Maxillary palp **ST-** Sensilla Trichoidea, **Stc-** Sensilla Trichoidea Curvata).

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